

Chemistry Math and Metrics Tasks 1-5

Student directions

1. In the number 120.0340, how many significant figures are there?

- a. 5
- b. 6
- c. 7
- d. 4

2. For the number 1234.567, which number represents the hundredths place?

- a. 2
- b. 6
- c. 3
- d. 7

3. Put the following numbers in order of increasing precision.

134.56; 197.5; 199; 114.437

4. Students are writing a procedure to determine the mass of a single paper clip.

They have a balance that only measures to the 0.1g level, and their instructor has indicated that the lab result should ideally have at least 2, better 3, significant figures. Their research indicates that a single paper clip will most likely have a mass between 0.8 and 1.0 grams.

- a. Write a testable hypothesis for this lab, including both the independent and dependent variables.
- b. What data will the students need to collect?
- c. If the balance reads 734.7 g for the mass of 805 paper clips, what is the correct average mass of one single clip?
- d. If the balance was not properly zeroed, and the reading was 0.50g too high for the mass of the 805 clips, what would the correct mass of the 805 clips have been?
- e. When the situation in part d occurred, did it affect the precision or the accuracy of the students' data? Explain your answer.
- f. Do they have the desired number of significant figures for their lab result?

Support material

Markschemes/marketing notes:

Instructions for using this markscheme:

- Each line of type, or set of lines, reading from the beginning of a line to the semicolon (;), is one point. That point MUST be earned using the information given on that specific answer.
- If words are underlined in the answer, they MUST be present in the student's answer to receive

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that point.

- If OWTTE (Or Words To That Effect) is present - any explanation which conveys the same meaning is acceptable.
- For multiple choice - ONLY the given answer may earn points - if more than one answer is given, the point is lost.
- If an answer contains a slash (/) before reaching the semicolon, it means that the answer may be given as the information on either side of the slash, and any one of the multiple versions counts towards that particular point.
- One point per line maximum - points earned on one line do not carry over or add to the answer value of the rest of the problem, even if multiple good answers, or additional correct material, is given.

1.	C.	(1)
2.	B.	(1)
3.	199; 197.5; 134.56; 114.567	(+2) if all in correct order (+1) if one or more in wrong order, yet at least 1 correct (+1) if all correct but in backwards order Note: if numbers are not copied correctly, but the answer is given correctly using the miscopied numbers, maximum (1) point can be earned. All must be placed correctly for any credit.
4.		
a.	independent variable: type of paper clip; dependent variable: mass of clip; final answer must be in the form of a hypothesis;	(1) (1) (1)
b.	mass of container / instructions to tare balance mass of 10+ paper clips	(1) (1)
c.	0.913 g	(1) for number (1) for 3 sig figs (1) for unit
d.	734.2g	(1) (no penalty for missing units or incorrect sig fig)

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e.	affects accuracy; balance gave wrong absolute mass, but the error was the same for each measurement, so the correct mass was not found, but the amount of the total attributed to each clip would have been the same proportion of the (inaccurate) total - OWTT	(1) (1)
f.	Yes	(1)

Examiner notes:

Examiner Notes about CHEMISTRY Math and Metrics Tasks 1-5

Question 1:

Type: m/c

DP area assessed:

Chemistry, Unit 1, Quantitative Chemistry Unit 11, Measurement and Data Processing Units 4,5,6,7,8,9 (i.e., all calculations in chemistry)

Teacher info: This question is important, even though it seems simplistic. It is an essential first step in using numbers in chemistry to be able to determine what the numbers are telling the chemist – not just their quantitative information, but also their communication about how accurate, how reliable, how detailed, the information is, or is not. The DP relies on students knowing this information without further discussion, and points are lost on both the internal and external assessments if significant figures are not used consistently and correctly.

Question 2:

Type: m/c

DP area assessed:

Chemistry, Unit 1, Quantitative Chemistry Unit 11, Measurement and Data Processing Units 4,5,6,7,8,9 (i.e., all calculations in chemistry)

Teacher info: This question is a very simple one, designed to reinforce the importance of reading and interpreting the information in a number accurately. A surprising number of students will have trouble with this information, and it is a strong indicator of which students will find the quantitative part of chemistry daunting until a review of this basic math information is performed.

Question 3:

Type: Short answer

DP area assessed:

Chemistry, Unit 11, Measurement and Data Processing

Teacher info: This question is an important one mostly for its style. There are quite a number of this style question at the DP level, and it is important that students learn to transcribe numbers correctly while evaluating the answer, and to read the instructions carefully and follow them exactly, since points are lost if the question is answered backwards.

Question 4:

Type: Short Answer

DP area assessed:

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Chemistry, Unit 11, Measurement and Data Processing
Chemistry, Internal Assessment (lab work)

Teacher info: This question provides a good evaluation of the ability of the student to design and think through the lab process. There is an opportunity for the student to practice explicitly listing the independent and dependent variable in an experiment, and for the student to create a hypothesis. This is a critical first step in the creation and performance of a lab, which is the key focus of DP internal assessment. The second part of the question tests whether a student can evaluate error sources in foundational ways, and if they can apply the key concepts of significant figures to the proper reporting of their answers in a lab situation.

Subject:
Group 4 / Sciences

DP Component & Criteria:
Short response (GDC required)

Component type:
Internal

MYP Criteria:
Group 4 / Sciences